REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 9-12 and 30-32 will be active in the application subsequent to entry of this Amendment.

The claims have been amended in order to more particularly point out and distinctly claim that which applicants regard as their invention and to address the formalities rejections stated in the Action. More specifically, the subject matter of claims 6 and 7 (plus additional subject matter) has now been incorporated into independent claim 30. In doing so, the substance of claim 6 was revised to replace "non-circular" with –oval, elliptical or rectangular—for the reasons explained below. In addition, claim 6 was revised in the last line to refer to a "side wall of the reactor" for purposes of clarity and to agree this part of the claim with the description of the invention, notably the value Dw in Figures 3 and 4 of the drawings. Additional information contained on page 26 of the specification relating to the distance from the point the fuel impinges against the oxygen-containing gas and the diameter of the fuel ports has been included in new claim 30, again as discussed in the remarks that follow.

In overview claim 6 attracted a single rejection of alleged "obviousness" over a single reference while three other prior art-based rejections were advanced against other claims then pending. Thus, by the incorporation of claim 6 into claim 30 there is really only one prior art-based issue to be resolved. For completion of the record however all of the four prior art-based rejections are addressed as well.

In the paragraph bridging pages 2 and 3 of the Action, claims 6 and 32 are rejected as being indefinite, since the dimensions of the oxygen-containing gas feed port having a non-circular shape are not specified.

Applicants have noted the examiner's comments and offer the following information and related claim amendments. The shape of the oxygen-containing gas feed port is specifically described in the present specification as follows:

Page 22: "··· shape having a major diameter and a minor diameter, such as oval or oblong, is more effective than [a] circular [one] for expediting heating or dilution of the oxygen-containing gas. Therefore, an elliptical or roughly circular shape is preferred for fuel feed port (5) while a rectangular shape such as slit shape is preferred for oxygen-containing gas feed port (6) ···";

Page 23: "··· when oxygen-containing gas feed ports (6) are of a shape having a major diameter and a minor diameter, the respective feed ports are preferably arranged so that the straight line extending from the major diameter will pass the center of the circle (see FIG. 2(E)) ···"; and

Page 43: "··· the shape of oxygen-containing gas feed ports (6) was rectangular with the longer side ··· Said ports (6) were so arranged that their major diameters would all be directed to the center axis of the furnace ···".

The expression "non-circular" shape as previously used in claim 6 was intended a generic expression of the above-described shapes, i.e., it means a shape having major and minor diameters such as oval or oblong (elliptical) and rectangular shapes. These dimensions will vary depending upon the gas flow rate, and are determined so as to provide the flow rate as claimed in claim 9.

In order to advance prosecution the claim is amended to express "non-circular" as "oval, elliptical, or rectangular" on the basis of these descriptions as noted above.

The Examiner objects that claim 32 is indefinite, since the numbers of the fuel feed port(s) and the oxygen-containing gas feed port(s) are not specified, i.e., whether only one port or plural ports are present as for the respective feed ports, is not clear.

In claim 32, it is intended to provide, in addition to the structure capable of high-temperature air combustion as defined in claim 30, an ordinary burner is also included as an auxiliary means. The provision of such a burner providing normal combustion enables the fuel and oxygen-containing gas to be intimately mixed with each other upon the

increase of operation of the furnace, resulting in industrial advantages such as a smooth rise of operation of the furnace (see page 23 of the present specification).

Meanwhile, in the present invention, the numbers of the fuel feed port(s) and the oxygen-containing gas feed port(s) are optional and not particularly restricted. Only one fuel feed port and only one oxygen-containing gas feed port may be provided as claimed in claim 30. Claim 32 allows for the possibility of "additional" ports, as stated in the claim and explained in the specification. The numbers of these ports are optional and will depend merely upon individual design matters. Applicants believe claim 32, a dependent claim, is clear as presently worded, however if the examiner prefers a different form of expression applicants will be happy to consider same.

Claims 10 to 12, 30 and 31 are rejected under 35 USC §102(b) as being obvious from Mise U.S. 5,772,975 ('975). These claims are not anticipated.

Mise shows a view in which a fuel feed port and an oxygen-containing gas feed port are independently provided on the same plane, i.e., on an inner wall surface of a furnace in a spaced relation to each other. On the other hand, the present invention is characterized in that the two kinds of ports, i.e., the oxygen-containing gas feed port having the specified shape, and the fuel feed port, are open to the same plane so as to substantially flash with the inner wall surface of the furnace. '975 fails to show the specific structure that "the fuel feed port and the oxygen-containing gas feed port of the specific shape are open to the same plane so as to substantially flash with the inner wall surface of the furnace". For completeness, applicants also observe Sakaue et al U.S. 5,264,199 ('199) also fails to show this specific structure.

The fuel feed port described in '975 is an ordinary combustion burner whose opening end is projected from the inner wall surface of the furnace. Therefore, the construction and process shown in '975 is based on a different technical concept from that of the present invention.

Claims 30 to 32 are rejected under 35 USC §102(b) as being anticipated by the reference cited '199. There is no anticipation for the reasons that follow.

In the production furnace described in the '199 reference, the fuel feed port is arranged within the oxygen-containing gas feed port. This reference discloses merely a so-called normal combustion burner as conventionally used. In this arrangement, the fuel feed port and the oxygen-containing gas feed port of the reference cited '199 are not independently open to the same plane – that is relative the inner wall surface of the furnace in a spaced relation to each other unlike those of the present invention. Claim 30, which requires the fuel feed port and the oxygen-gas containing feed port to be "independently spaced apart from each other", hence there is no anticipation.

Therefore, the high-temperature air combustion according to the present invention cannot be accomplished from the structures and teachings of the '199 reference as it is based on a different technical concept from that of the present invention.

Claims 7 and 9 are rejected under 35 USC §102(b) and §103(a) as being anticipated by and obvious from Mise '975. Applicants disagree.

In the descriptions and drawings of the '975 reference, there is no description or suggestion of the limitations as to locations and sizes of the fuel feed port and the oxygen-containing gas feed port specified in claims 7 and/or 9.

On page 26 of their specification applicants state that "··· it is preferred that the distance Lf taken till the fuel impinges against the oxygen-containing gas and the opening diameter Df of fuel feed ports (5) have the relation of $Lf \geqq 30Df$, particular $Lf \geqq 35Df$ ··· However, if Lf is too large, combustion may fail to take place in the reactor, so that preferably $Lf \leqq 100Df$ ···".

Only when the above requirements defined by the present invention and now incorporated into claim 30 are satisfied, does it become possible to lower the peak combustion temperature, that is, flatten the distribution of combustion condition in the first reaction zone, and effectuate perfect combustion with stability at a high temperature of not lower than 2,000°C and an air ratio close to 1 with low discharge of NOx, without damaging the refractory of the reactor interior structure. On the other hand, even though

a combustion temperature range of 1700-2400°C is described (column 3, line 16), the production furnace and the combustion method described in Mise et al must be operated at a combustion gas temperature of not more than 1,800°C, as the practical chosen combustion gas temperature (the temperature at the second reaction zone) as described in the Examples of the specification is as follows:

As described on page 6 (first paragraph) of the present specification, when maintaining a temperature of the feedstock hydrocarbon injected area at 1,800°C or higher, the adiabatic flame temperature of the combustion section becomes 2,100°C or higher, which damages the refractory constituting the furnace and renders it unable to carry on a stable continuous operation. Namely, it is necessary to increase the temperature of the combustion section (the first reaction zone) to 2,100°C or higher so as to maintain the temperature of the feedstock hydrocarbon injected area (the second reaction zone) at 1,800°C or higher. However, this is difficult because such a high temperature is much higher than the melting temperature of heat resistance refractory commonly used in the art, such as alumina refractory and (cromia) magnesia-type refractory. Therefore, this is not industrially practical.

The operation of the process of the present invention becomes possible only when these requirements are satisfied. However, these requirements are not suggested from the figures of the references cited.

For the above reasons it is respectfully submitted that claims 6 and 7 (including also specifying the ratio of the distances and diameters of the fuel ports) are combined with claim 30. Accordingly, claims 9-12 and 30-32 of this application define inventive subject matter and are compliant with 35 USC §112, second paragraph. Reconsideration, entry of this Amendment and allowance are solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____
Arthur R. Crawford
Reg. No. 25,327

ARC:eaw
1100 North Glebe Road, 8th Floor
Arlington, VA 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100